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Rural Equitable Economic Growth Activity

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RURAL EQUITABLE ECONOMIC GROWTH ACTIVITY

Contract No. 519-C-00-94-00154-00

SECOND REVIEW OF PROGRESS ON CASHEW PRODUCTION, PROCESSING AND MARKETING IN COOPERATIVA DE REFORMA AGRARIA LA MARAÑONERA DE R. L. CORALAMA

Prepared by:
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National Cooperative Business Association

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SUMMARY EXECUTIVE

The consultant has undertaken two previous assignments for National Cooperative Business Association (NCBA) and CRECER in El Salvador. In January 1997 the consultant's report Review of Prospects for Cashew Production, Processing and Marketing at CORALAMA reviewed the operations and made a number of recommendations regarding the important issues that were limiting progress.

The consultant undertook two separate assignments in Australia regarding (1) Insect Pests in El Salvador, August 1997 and (2) Report on Nutrition, November 1997. The purpose of these two reports was to increase the available knowledge to allow progress on formulating programs on the two important issues.

In December 1997 the consultant's report Review on Progress of Work On Cashew Production and Processing at CORALAMA examined the progress made since his first assignment and made a number of new recommendations to meet the changed situation.

The purpose of this report is to:

1. Briefly review the current status of operations.

2. Evaluate progress on the critical issues previously identified.

3. Make new recommendations to meet the new situation.

A very brief summary of current operations and progress on the critical issues previously identified is given below as follows:

1. Genetic Improvement Program

As cashew is an open pollinated seedling, and therefore the performance of seedling trees can be highly variable. The only way to achieve a consistent level of high quality trees is to use selected grafted trees.

The consultant outlined the methodology and timetable for undertaking a genetic selection program at CORALAMA in his previous reports. During this current assignment the consultant examined the work underway by CORALAMA in this program, he has found that CORALAMA has made fundamental mistakes in the methodology.

These errors involve:

1. Making too few initial selections (50 trees), thus starting with a very narrow genetic base and

2. Putting too much emphasis on inappropriate criteria and very little on the key criteria in the selection process. In addiction the selection process must be based on data relevant to the characteristics being selected and the consultant has been unable to find any data at CORALAMA.

The consultant has made recommendations in this report to correct these errors (sections 3.4, 3.5).

2. Pest Control

The major pest at CORALAMA and elsewhere in El Salvador is *Leptoglossus sp,* this pest can cause a crop loss of about 40 % each year. Currently there is no effective method of organic control as the insecticide previously in use (neem) has proved to be ineffective against this pest.

The consultant's previous recommendations included the University of El Salvador undertaking research into the bio-ecology of *Leptoglossus sp* and also investigating the potential of alternative organic insecticides. The consultant reviewed the progress of the three separate research programs underway at the university, two of these are directed on *Leptoglossus sp* and the third on *Selenothrips rubrocinctus* which is also an important pest of cashew in El Salvador.

Of the three programs, two have only recently commenced and have little to report. One program just commencing Evaluation of Organic Products against Thrips is being inhibited because of a lack of technical information about thrips and the university has asked the consultant for help.

The third program Diversity and Abundance of Cashew Insect Pests in El Salvador has been operating for nearly 12 months and has achieved some results. It has collected a number of insect species which require formal identification by a taxonomist before conclusions can be reached and the university has asked the consultant for assistance. The insects collected include two potential beneficial insects (1) *sp Phoridea Diptera Largidae* is a potential parasite of adult *Leptoglossus sp* while (2) *Debilia sp* is a potential predator of *Leptoglossus sp.*

This work is encouraging and requires external technical assistance to give results and it should continue. However the consultant cautions that it may be a long road from finding a potential beneficial insect and having a working biological control system.

Because of the importance of the insect pest problem at CORALAMA and elsewhere in El Salvador and the likely long time frame to find a biological solution, the consultant is proposing an additional approach. He believes that an additional avenue of investigation should be the introduction and trial of the green ant, *Oecophylla smaradgina* which has proved to be a highly efficient predator of cashew insect pests in Australia. (see section 6.0).

Oecophylla sp are indigenous to Australia, Asia and Africa but unfortunately are not present in North or South America. The end of the wet season in El Salvador (November/ December) is the correct time for the importation of the ant. The proposed trial to give a preliminary evaluation of the ant as a biological control agent under El Salvador conditions would take about 4 to 5 months. The physical requirements to conduct the importation and trial of the ant are not difficult, however the approval from official authorities in El Salvador may be more complicated.

3. Nutrition

Prior to the consultant's first visit in January 1997 CORALAMA and some of the other plantations were applying a 'home made'compost to the cashew trees but they no idea as to the nutritional status of the compost or of the cashew trees. Following the consultant's recommendations in the January 1997 report, Analytical Solutions SA, Guatemala undertook an extensive range of nutritional analysis of soil, compost and foliar condition of the trees.

Following up on this analysis a proforma nutritional program was worked out and recommended. Unfortunately no compost has been applied at CORALAMA since June 1997 and the situation is similar at the other plantations. CORALAMA did make the application of micro-nutrients in 1998 as recommended to part of their plantation but it's beneficial effect was probably negated by the absence of the macro-nutrients. This is unfortunate as the correct application of nutrients can have a significant impact on yield. Simple trials in India and elsewhere have demonstrated that yield increases of 50 % or more can be achieved by adding N P K to rainfed cashew trees.

The reasons given for the non use of compost were varied but the consultant believes that the effort required to both make the compost and distribute it in it's present form around the plantation may be the real reason for it's non use. With this in mind it is proposed that CRECER investigate the option that an external body (NILO) be contracted to supply CORALAMA with compost that is packaged in appropriate sized parcels for application. The packaging could be one compost packet for one tree. The advantages here would include (1) a higher value compost (being made by organization with greater expertise) and (2) greater likelihood of use if application is made easier.

It is important to re-introduce a balanced nutrition program or future yields will be compromised.

4. Plantation management

Cashew requires direct exposure to sunlight to produce fruit therefore the crop is only produced on the canopy surface. Because of this the issue of tree spacing and canopy inter-growth is important in cashew. The correct spacing for cashew is dependent on the growing conditions and the genetics of the tree as tree shape is an inheritable characteristic.

In his previous reports the consultant made recommendation on pruning and tree thinning in the various plantations. Cashew trees are sometimes planted at a high density to obtain early yield and the trees are later thinned to accommodate their increasing size. On some of the plantations (San Ramon. Gualuca, Chilanguera, Maquigua and El Platanar) trees were planted on a 6 meter by 6 meter spacing. In a few cases the growing conditions are so poor so as to limit tree growth (El Platanar) so it is very likely that they will ever require any tree thing. In the other plantations it will be required at the appropriate time and recommendation was previously made to thin the 286 mz at San Ramon and the 50 mz at Gualuca.

During 1998 some 100 mz at *San Ramon* was thinned from 6m by 6m to 12m by 12m by removal every alternative row. At Gualuca some 50 % of the plantation was given a pruning, the consultant was advised that Gualuca intent to commence the tree thinning next year.

5. Processing

In his two previous assignments the consultant inspected the CORALAMA factory operations and made a number of recommendations for improvements. On this assignment he found that the CORALAMA factory had been closed for about one year and did not process any crop in 1998, this crop was sold as raw nuts to a buyer in India The consultant could not gain access to the factory building which was in a secured state so he cannot make any comment on this subject in this report.

The consultant is advised the factory closure is caused by a dispute between CORALAMA and the society representing the other plantations.

The consultant was able to inspect the processing factory at San Ramon which had been constructed with support from the Canadian government. This factory uses similar technology (steam autoclave and semi manual shelling) to the CORALAMA factory but on a smaller scale.

The Sam Remon factory has the annual capacity to process up to 90 MT of raw nuts using one shift. The factory records of the processing 2 MT of crop between 22 March and 4 April were examined by the consultant. The results were similar to that previously achieved at CORALAMA. Again insect damage caused a major croploss, about 35 % of final product.

6. Marketing

At the time of his previous visit to El Salvador the CORALAMA factory was processing but no sales of final product had been made from the 1997 crop. The consultant has no details on kernel sales from the 1997 crop.

CORALAMA did no processing in 1998, so the crop was sold as raw nuts to Vijalaxmi in India (apparently via Sumotomo). The details available to the consultant as regards disposal of the crop are as follows :

	MT processed	Sold to India Volume (MT)	Price/MT (fob)
1996	100	423	US$ 680
1997	136	476	US$ 475
1998	nil	460	US$ 675

The consultant comments as follows :

1. Prices received for raw nuts are low, probably due to poor quality (insect damage), and because the small volumes and distance from India lead to a low bargaining position for CORALAMA.

2. Indian buyers will not pay any premium for buying "organic product".

3. To establish reputation as a credible organic supplier CORALAMA must be in a position to be a reliable source of product.

New Recommendations

The following additional recommendations are made as part of this report:

1. Genetic Selection Program

This work must be undertaken correctly and the procedure to follow was previously laid down in the report of December 1997 section A Plan for Genetic Improvement. ALSO Section 3 of this report gives information on what action should be followed now.

It would be very helpful if the consultant could view the data from the selection process (and when available this could be sent to him in Australia for comment).

2. Pest Control

The following work is required to assist the on-going entomology effort:

- Identification of insect species collected by University of El Salvador, this work to be done by taxonomist Dr. Malipatil and the consultant in Australia.

- Literature search and report of thrips in cashew by consultant and associates in Australia to assist in the current university entomology study.

S Purchase and postage by consultant of supply of pyrethrum for trial as organic insecticide in El Salvador.

- Extension (preferably for 12 months) of research project Diversity and Abundance of Insect Pests in Cashew This extension should concentrate on collecting more information on the potential predator and parasitic capabilities of the two species identified.

- A new initiative, the importation and trial of *Oecophylla smaradgina* as a predator of insect pets in

El Salvador.

3. Nutrition

CRECER to investigate the prospects of Nilo (or other organization) making and packaging an‘easy to use’ compost to facilitate it’s use at CORALAMA and elsewhere.

4. Disease Control

A new initiative, anthracosis is a significant problem causing continuing crop loss in El Salvador. Current treatments appear to be only partially successful. To date little is known about the fungal infection cycle in cashew in El Salvador. A limited program 6 to 12 months) by the Crop Protection Department, University of El Salvador (Ing. Wilberto Lara Rodriguez) to investigate the infection cycle should allow a more effective planning of remedial measures.

SECOND REVIEW OF PROGRESS ON CASHEW PRODUCTION, PROCESSING AND MARKETING IN COOPERATIVA DE REFORMA AGRARIA LA MARAÑONERA DE R. L. CORALAMA

A. Background to this Report

A1. Introduction

The consultant has undertaken two previous assignments for the client in El Salvador. In January 1997 he visited for 4 weeks and produced his report Review of Prospects for Cashew Production, Processing and Marketing in Cooperativa de Reforma Agraria La Marañonera de RL (CORALAMA) San Miguel, El Salvador.

In this assignment the consultant familiarized himself with the status of the agronomic, processing and marketing situations at CORALAMA. He defined the barriers to progress in the plantation and recommended future work on genetic improvement, nutrition, and pest control as having the highest priority. The consultant also examined in detail the processing system in use and following some trials he made some recommendations to improve efficiency. This report also gave technical information on cashew agronomy and processing systems so as to provide a source of information to the client.

Following a request from the client the consultant produced two specific technical bulletins to be used as working documents by the units in the cooperatives. These technical bulletins were:

1. Report on Major Insect Pest Problem at CORALAMA, El Salvador. August 1997.

2. Report on Nutrition, SCPM Cashew Plantations, EL Salvador. November 1997.

The consultant made a subsequent visit to El Salvador in December 1997 for 3 weeks and completed his report Review of Progress of Work on Cashew Production and Processing in Cooperativa de Reforma Agraria La Marañon de RL (CORALAMA) San Miguel El Salvador. With Special Reference to Genetic Improvement, Nutrition, Disease and Pest Control and Processing Improvements.

In this report the consultant examined the progress made since his initial assignment and made additional recommendations regarding the plantation, processing and marketing. This report also included a self contained section intended to be used as stand alone technical bulletin, Techniques to Improve Genetic potential on Cashew Plantations.

The following is a summary of the important issues on which the consultant made recommendations in his previous reports.

B. Recommendations

B1. Genetic Improvement

The consultant proposed a work plan and time table to carry out a genetic improvement program at CORALAMA. The work plan included the initial parential selection criteria to be used, required data to be collected to make final selections, method of vegetative propagation to be used for multiplication of selections and finally the design and operation of progeny testing. There was also a general plan for the large scale tree renewal (top working) at CORALAMA.

The initial timetable for the parental selection process as recommended by the January 1997 report was for this work to be carried out prior to and during the 1997 harvest. However CORALAMA were unable to carry out any work and this then required an adjustment to the project plans.

In response to these delays the December 1997 report recommended that the selection work now be carried out prior to and during the 1998 harvest with the progeny of the final selections being planted in the field ready for performance monitoring by July 1999.

B2. Pest Control

Leptoglossus sp was previously identified as the major pest causing a 35 % loss of crop in the processing factory and the consultant's previous work Report on Major Insect Pest Problem at CORALAMA August 1997 had summerize all the available information on *Leptoglossus sp*. In this report the consultant made recommendation that investigative work should be commenced at University of El Salvador to improve the knowledge on the bio-ecology of this pest in the context of the site at CORALAMA and to commence studies on methods of biological control.

B3. Nutrition

Following previous recommendations by the consultant, Analytical Solutions S. A., Guatemala had undertaken soil, compost and foliar analysis at CORALAMA and in the other plantations July 1997. This analysis confirmed that there were a number of nutritional deficiencies on the various plantations. The consultant recommended the following:

1. The maximum use of poultry manure in the compost.

2. The planting of various legumes in the plantation to increase available nitrogen.

3. Use of natural minerals (natural gypsum, potassium chloride).

4. Foliar spray of the required micro- nutrients.

This program was to be carried out during 1998 and following this a subsequent foliar analysis should be carried out to determine the new nutrition status of the trees.

B4. Plantation management

It was previously confirmed that an inappropriate tree spacing could lead to inter-growing canopies between trees. As cashew only bears fruit on the surface of the canopy this could lead to decreased yields. Inter-growing canopies can also lead to increased incidence of anthracosis which can better survive in conditions of dense canopy. The consultant had previously recommended a program of establishing a satisfactory tree population and canopy cover in the plantations to maximize potential yield and reduce incidence of anthracosis. This was to be achieved by either (1) pruning or (2) tree thinning depending on the scale of the problem.

B5. Processing

The consultant had previously made recommendations on various aspects of the processing system at CORALAMA including :

1. Crop grading (to improve factory efficiency).

2. Crop drying, (concrete area for drying).

3. Crop storage (increased storage area, storage in hessian sacks) .

4. Improved worker cleanliness and security.

5. Improved wages to attrack more labour for shelling.

The consultant also made comment that the factory at CORALAMA had the capacity (with minor adjustments) to process the entire El Salvador crop and that the construction of new a factory at San Ramon had little macro economic justification although they could be viewed as giving local social (employment) benefits.

B6. Marketing

Up to now the only export market for organic product was Ports West of Canada. To assist the marketing effort the consultant in January 1997 introduced two potential buyers in Australia for about 15 MT of organic product (about 60 % of CORALAMA processed output in 1997). However there was no follow up by UCRAPROBEX to these opportunities. As a consequence in the report of December 1997 the consultant had suggested that CRECER should consider undertaking the marketing function. It proved impractical for CRECER to assume the marketing function and it remains with UCRAPROBEX.

C. Function of the Report

C1. Review of Current Status in Production

C1a. Crop Potential

The following is a summary of the planted area and crop details of CORALAMA and the Sociedad de Productos de Marañon.

Plantation	Area hectares	Age of trees (yrs)	No of trees	MT raw nuts 1995/96	MT raw nuts 1997/98
Coralama	800	26 - 33	84,000	533	452
San Ramon	231	6 - 9	55,000	45	15
Chilanguera	167	5 - 7	34,000	*	*
Maquigua	60	5	16,000	*	*
Gualuca	33	13	9,000	*	*
El Platanar	40	7	11,000 *	*	
				578	467

The past history of the CORALAMA crop has been as follows:

	1993/94	1994/95	1995/96	1996/97	1997/98
MT	400	437	541	533	452

Source : UCRAPROBEX

There appears to have a significant improvement in yield at CORALAMA between 1993/94 to 1995/96. As the trees are all mature so the only variables effecting yield will be the environmental conditions and level of management and inputs. It is most likely that the use of compost for added nutrients was the main reason for this increase as prior to this period there was no nutrition program.

The crop reduction since 1996/97 has probably been at least partly caused by the fact that no compost has been applied since June 1997. An analysis of the yield per hectare at CORALAMA over the past few years is as follows:

	1993/94	1994/95	1995/96	1996/97	1997/98
kg/hectare	500	546	676	666	565

The yield per hectare for mature rainfed seedling trees with a medium to low level of management and a few inputs in most producing countries is about 500 - 600 kgs per hectare. In this case CORALAMA is about average in performance so a large scope for improvement remains. While a genetic selection program to produce superior grafted trees is the most important way to improve performance, this remains a longer term project. In the shorter term better management of the seedling trees including a good control of inputs (nutrition, tree pruning, pest control) should have the capacity to raise yields to 800 kg to 1,000 kg per hectare as demonstrated elsewhere in the world.

San Ramon suffered a significant reduction in crop 45 MT in 1996/97 to 15 MT in 1997/98. This was almost certainly as a result of a previous inappropriate use of *endosulphan* insecticide in January 1998 which led to a complete defoliation of the some cashew trees. The crops in the remainder of the plantations were not sent for processing as they were considered too small to warrant collection.

The potential crop for 1999 for CORALAMA appears unclear to the consultant. Some of operatives at CORALAMA were optimistic of the outcome and were predicting a crop of about 560 MT significantly higher crop than 1998. The consultant is less optimistic because of the following problems:

1. It is clear that anthracosis is a bigger problem this year in virtually all the plantations. This may well be an indirect result of the Hurricane "Mitch" (October 1998) when it left a legacy of flooding.

2. CORALAMA have not applied compost since June 1997 but did make a limited (800 manzanas) foliar application of micro-nutrients in 1998/9 (as previously recommended by the consultant). However the impact of this foliar spray was probably lost by the absence of the major nutrients(N P K) provided by compost.

3. The incidence of pests is variable this year. The main pest *Leptoglossus sp* (chinche) appears to be present in similar numbers however there has been a very limited effort in pest control measures during 1998 and into 1999, no doubt due to fact that the only organic insecticide available (neem) is not effective so there appears no point in using it. As yet they have no ready alternatives to replace the neem (apart from the effective but highly costly method of manual control.

   On balance the damage from pests will be at least equal to last year.

   The San Ramon crop should recover from the disaster in 1998 caused by inappropriate use of chemicals. No compost has been applied and there are medium levels of insect and anthracosis damage. The 1999 crop could be similar to 1996/97.

   The consultant also inspected Chilanguera plantation. This year it appears that the major pest (at Chilanguera) of *Selenothrips rubrocinctus* are less evident than previously, although anthracosis is worse. No compost or other inputs are used. Chilanguera can expect a small crop this year, say 5 to 10 MT.

C1b. Tree Numbers and Spacing

The situation at the time of the consultant's previous visit in December 1997 was as follows:

	Area (mz)	spacing	trees per manzana	total trees	Total
CORALAMA	502	12m X 12m	46	23,100	
	300	14m X 14m	68	20,400	
	265	8m X 8m	104	41,300	84,800
San Ramon	286	6m X 6m	182	52,000	
	60	12m X 12m	46	2,700	54,700
Chilanguera	120	8m X 8m	104	12,400	
	130	6m X 6m	182	23,900	36,300
Maquigua	75	6m by 6m	182		16,500
El Platanar	60	6m by 6m	182		11,000

					203,300

Allowing for losses since the original planting 6 %, the tree numbers on my last visit were probably about 200,000. It is anticipated that Hurricane "Mitch" in October 1998 may have damaged a further 5 % to 8 %.

The theory of high density planting (mainly 6m by 6m in these plantations) allows a more rapid early yield but the trees need to be thinned out once the canopies grow into each other. This is because cashew requires exposure to sunlight to fruit and hence the crop only bears on the canopy surface.

Only at CORALAMA has an appropriate tree thinning been undertaken. It is still appropriate for CORALAMA to undertake pruning where canopies are a problem in mature trees. In practical terms they should restrict this work to the trees on the flat land.

In his report of December 1997 the consultant recommended that tree thinning be undertaken as a matter of urgency in two areas of most need. these were (1) 286 manzanas of 6m by 6m planting at *San Ramon* and (2) the 50 manzanas of 6m by 6m planting at Gualuca.

The consultant has ascertained that the following work has been completed:

1. 100 manzanas of the 6m by 6m planting at *San Ramon* has been thinned to a spacing of 12m by 12m. About 180 manzanas remained to be done.

2. About 50 % of the Gualuca trees received a significant pruning in 1998, the consultant was advised by the President of Gualuca community that a tree thinning exercise would take place next year.

The planting at Chilanguera and Maquigua are still immature and no tree thinning will be required for some time. The trees at El Platanar are growing in unfavourable soils conditions (heavy clay) and they are unlikely to grow sufficiently to require pruning or thinning.

D. Genetic Improvement Program

D1. The Original Recommendations

The consultant originally made recommendations about a genetic selection program in his report of January 1997. Unfortunately CORALAMA did not carry out any work on these recommendations.

The consultant renewed his recommendations in his second report of December 1997. In this report the consultant defined in detail both the specific steps and the time table for the work to be carried out in this genetic improvement program.

This timetable and activities as outlined by the consultant were as follows:

Date	Action
prior to 1998 harvest	- by observation screening select 250 best trees based on several criteria (yield, nut size, tree shape etc).
July 1998	- collect data from best 100 trees. Data required must include total yield, kernel size, recovery %.
Nov 1998	- based on data on 100 trees, select best 25.
	- graft 30 replicates of each of the best 25 and plant in a budwood block for observation (5 manzanas).

This budwood block has two purposes:

1. It allows the evaluation of the performance of the new clone. Only new clones that perform to the required standard should be used.

2. It provides a source of budwood for the future production of grafted trees.

D2. Work Completed at CORALAMA

At CORALAMA it appears that a German government aid program in El Salvador has given financial assistance to CORALAMA to operate a nursery. This program is for one year (starting February 1999) and covers the cost of materials and salary of the nursery manager. At the time of the consultant's visit the nursery was operational. It was of simple design with a simple native bust shade and 6,000 plastic planting bags already filled. Watering was by hand.

The work already carried out on genetic selection as described to the consultant was as follows:

1. In late 1997/early 1998 one CORALAMA operative made a visual selection of 50 trees based on the following criteria (shape of tree, size of nut, size of apple). In October 1998 hurricane Mitch damaged 15 of these 50 trees leaving only 35 of the original selections.

2. In November 1998 another CORALAMA operative made a new selection of 15 trees based on the following criteria (tree shape, time of flowering, size of apple, size of nut, quick drying nuts).
3. CORALAMA now plan to graft 200 replicates of each of the 30 final selections, this grafting will presumably take place when the post harvest flush brings new growth, November / December 1999.

D3. Comments on Current CORALAMA Activities

The consultant makes the following comments about the program being carried out by CORALAMA.

1. The consultant had proposed that the initial screening process be a wide one 250 trees, which would be quickly cut down to the elite group. It is necessary to start with a wide process as we are trying to find the best genetic material in the whole plantation and there are 80,000 trees in CORALAMA. The consultant believes that a selection process that starts with 50 is too narrow, especially when it reduced to firstly 15 and then 30 by intervention of a hurricane.

2. CORALAMA has confused both the steps required in the genetic selection process and the criteria to be used for selection. The consultant defined in detail in his previous report that:

S Final selection process must be made from firm data only. This means you do not select what you are going to graft and plant in the field until you can accurately compare their most important characteristics. CORALAMA has (apparently) already made this decision before they have any data, they certainly were unable to provide the consultant with any data on their selection program. CORALAMA have given emphasis to non genetic criteria (ease of nut drying) and less important criteria (apple) and ignored the most important criteria (kernel size and recovery %.)

3. The program outlined in the December 1997 report required the collection of data from the 1998 harvest which was to form the basis of the selection process. In the event there was no collection of data in 1998 and this contributed to the current inappropriate situation.

   The consultant cannot give any assurances on the final outcome of the CORALAMA genetic selection process if it continues as they intend. It will be entirely a matter of extreme luck if a majority of the 30 selected parent trees selected so far have satisfactory levels of the critical criteria (total yield, kernel size, recovery %).

D4. New Recommendations

The consultant strongly recommends that CORALAMA undertake the following steps to rehabilitate their selection program with the utmost urgency.

1. CORALAMA must give highest priority to the key criteria for selection of a potential parent tree, as follows {(a) to ©} To undertake this analysis requires the use of a one lb sample of raw nuts which require careful shelling to collect the data for (b) ands (c).

S **Total Yield**

(Weight of total crop from one tree). There is no set level apart from that they should be amongst the highest yielders.

- **Kernel Size**

The smallest acceptable size should be the W 240 grade or larger . (W 240 means 230-240 kernels per lb, the next largest grade is W210).

S **Recovery %**

The ratio of kernel to whole nut. This means you weigh one lb of raw nuts, this sample is shelled and the kernels are weighed. A comparison is made between the weight of kernel and the raw nuts, for example if one lb of raw nuts yields 0.30 lb of kernel then the recovery % is 30 %. Only trees with a recovery % of 30 % or higher should be selected.

It is important that CORALAMA carry-out the (a) (b) and (c) analysis on their 30 selections. If any of these selections fail the test they should be discarded.

Other criteria are important but only come into consideration after the above three are satisfactory. These other criteria are:

S **Tree shape**

An upright tree shape allows for higher density planting as cashew only bears fruit on the surface.

S **Time of fruiting**

Early fruiting trees will harvest without risk of interruption from the wet season.

S Apparent disease and pest resistance, this is usually already determined by the important criteria if you get a good yield then it is highly likely that this tree already is not particularly susceptible to pets and diseases.

2. By effectively starting their screening with only 30 trees CORALAMA have made their selection program far too narrow. It may be too late in this harvest to do a full evaluation of more trees. However at the very minimum they should identify another 30 - 50 trees and undertake analysis on the key criteria (a) (b) and © as far as possible from this years crop.

3. Only parent trees that meet the critical criteria (a) (b) and © should be grafted in the nursery.

4. It is better to extend the selection program into next year, than to select sub-standard material just to save time.

The consultant also brought 3 kg of Brazilian dwarf seed for CORALAMA. From this 241 seed were planted in the CORALAMA nursery in April 1999. These seedlings should be planted in the budwood nursery for evaluation.

D5. Importance of Key Selection Criteria

The three most important selection criteria (as described in section 3.4) are:

D5a. Total Yield

Determined by both genetics and environmental / management.

D5b. Kernel Size

Lrgely determined by genetics.

D5c. Recovery Percent

Largely determined by genetics.

These criteria have the major impact on the value of the major product produced, but also can have a significant impact in the processing factory.

Firstly, larger kernels fetch higher prices, a sample of the relationship between grades and market prices is as follows:

Grade	Price (US$ per lb)

W180	3.20
W210	2.90
W240	2.70
W320	2.40
W450	2.15

Secondly, a crop that has a recovery rate of 30 % will yield a 50 % higher yield of final product than a crop with a recovery rate of 20 %.

The following (simplified) table based on the theoretical results from a single tree demonstrates the following:

Example 1.

Tree A		Total Value US$
Total yield	- 5 kgs	
Kernel size	- W 320	
Recovery	- 20 %	
Tree A yields 1 kg kernel (2.2 lbs) at US$ 2.35/lb		5.17

Example 2.

Tree B		Total Value
Total yield	- 5kgs	
Kernel size	- W210	
Recovery	- 30 %	
Tree B yields 1.5 kgs kernel (3.3 lbs) at US$ 2.90/lb		9.57

In the theoretical examples above both tree A and tree B have the same total yield. However improvements in kernel size and recovery rate for tree B gives 85 % more value than tree A.

In addition the processing of product from tree A will have significantly lower unit costs than tree A. There are a number of elements to this benefit, these are as follows:

1. The costs of shelling raw nuts is virtually identical regardless of what the recovery rate is. Therefore if the labour cost of shelling 1,000 kgs of raw nuts is US$ 80, then if recovery rate is 20 %, unit shelling cost of 1 kg of kernel is US$ 0.40. If recovery rate is 30 % unit shelling cost of 1 kg of kernel is US$ 0.26.

2. Larger kernels are easier to process so workers will break fewer kernels (whole kernels fetch higher prices than broken kernels).

3. Workers can achieve higher productivity (and earn higher wages) if processing larger kernels.

E. Nutrition

E1. Previous Recommendations

In July 1997 Analytical Solutions SA of Guatemala visited El Salvador and undertook soil, compost and foliar analysis on the various plantations. This analysis confirmed that all the plantations had a nutrient deficiency, especially N, P K, Cu and Zn. In response to this the consultant in his report of November 1997 Report on Nutrition made recommendations regarding the nutrition program. These recommendations included as follows:

1. Maximum use of poultry manure to increase N content of compost.
   Volume of compost to be increased to 35 lbs per tree per application.

2. Application of natural gypsum and natural potassium chloride.

3. Foliar application of micro-elements, boron, zinc, copper and magnesium.

4. Planting of legumes in plantation.

E2. Work Completed

In the event it appears that not much was achieved during 1998. Up to 1997 CORALAMA was applying 25 lbs of compost per tree twice a year, however after June 1997 no further applications of compost were made. The consultant was advised by CORALAMA officials that financial problems prevented them making and applying the compost, other sources (UCRAPROBEX who provide operating funds to CORALAMA) suggested that this was not the case and funds were available to CORALAMA.

CORALAMA did made two foliar sprays of sodium borate (1%), zinc sulphate (0.25 %), copper sulphate (0.5 %), and magnesium sulphate (1 %) to about 800 manzanas in two applications November 1998 and January 1999. The cost of applying these micro nutrients (as advised to the consultant) was as follows:

	Colones per Manzana
Cost of Materials	25.8
Labour	5.0
Aerial Application	70.0

	100.5

The consultant cannot predict what impact will occur when the major nutrients (N,P,K) are not applied but the micro-nutrients are corrected supplied. However it is quite possible that there could be no significant benefit gained from this unbalanced application.

CORALAMA did plant two species of legume (Bigna sinensis and canavale) in about 50 manzanas

of the plantation (recommendation 4 above) as part of program to increase N content of soil. Unfortunately it appears that cows belonging to the community entered the plantation and ate these legumes.

The consultant understands that there were no applications of compost at any of the other plantations (San Ramon, Chilanguera, Gauluca, Maquigua) during 1998. Representatives of Chilanguera and Gualuca advised the consultant that the funding provided from the society did not allow for this expenditure. The consultant understands that San Ramon did not apply any compost in 1998.

E3. Consultant's Comments

The consultant's comments are as follows:

1. The foliar analysis undertaken in mid 1997 indicated medium to significant nutritional deficiencies on all the plantations tested. (Coralama, San Ramon, Chilanguera, Maquigua, and Gauluca). The failure to make any attempt to correct these deficiencies will increasingly inhibit future cropping at all the plantations.

2. The cost/ benefit ratio of using a balanced nutrition program is very favorable. Research in India using only the major elements (N, P, K) in rainfed conditions has shown yield increases of about 50 % .

The costs of applying a balanced nutrition program at say CORALAMA are estimated as follows:

	basic cost	cost/manzana
(1) Compost - nilo quality (two applications each of 35 lbs)	20 c/quintal	630
(2). Micro-nutrients (materials +application)		100
(3) .Compost application labour		90
		820

It can reasonably be estimated that yields would increase 50 % to 75 %. A 50 % increase would be from about 333 kg/manzana (500 kg/hectare) to 500 kg/manzana (750 kg/hectare). Thus an extra expenditure of 820 colones/manzana on a balanced nutrition program should give a benefit (after processing) at 2,600 colones. Even allowing for the additional harvesting and processing costs this investment gives a cost/benefit ratio of about 1 unit cost to 2.0 units benefit.

The consultant is of the opinion that the time and effort required to make and apply compost on the plantations is the main deferent to it's use. The making of compost takes weeks and it then comes out of the pit in loose form which requires effort to put into manageable parcels to be carried out to the field for application. All this is viewed as a lot of work.

E4. New Recommendations

A possible solution to the achieving the application of a nutrition program may be for CRECER to initiate the following 'ready to use' compost arrangement:

1. Outside organization makes compost on contract. Use a specialist organization with a track record of making good product. Previous analysis of Nilo product has shown higher nutrient content than compost made on the plantations. The nilo formular could be adjusted to meet out nutrient requirements, an addition of poultry manure.

   Nilo could be asked to make compost in 'fertilizer bricks'of say 35 lbs by compression and/or binding of the compost (the previous recommended dose was 35 lbs, twice a year). This would make a convenient method of application ie put one compost brick on one tree.

2. CORALAMA would purchase the ready to use compost from manufacturer, Nilo.

   The above suggested arrangement could make it more likely that compost will be used and also have the advantage of applying a higher standard product.

F. Entomology

F1. Review of Events

Following the consultant's two previous visits to El Salvador (January and December 1997) the following points were made clear:

1. The major pest in all cashew plantations was *Leptoglossus sp* and this pest could cause a 35 % to 40 % loss of crop as judged in the processing factory. This rate of crop loss was clear to the consultant in his experiences in the CORALAMA processing factory.

2. *Selenothrips rubrocinctus* could also be an important pest, especially at Chilanguera and San Ramon. They appeared to be less evident at CORALAMA where there are mature trees. This is in keeping with our understanding of this pest as they tend to prefer open sunlight situations found with young smaller trees as opposed to the more shaded situations.

3. Almost no work had been previously undertaken on entomology in cashew in El Salvador so we had virtually no information on the bio-diversity of insects in cashew in El Salvador.

In his current inspections the consultant came to opinion that *Leptoglossus sp* impact was probably the same intensity as the previous year. He can normally make this judgement by reference to the state of the crop in the CORALAMA processing factory, unfortunately that is not possible this time as the factory is closed. However information from the San Ramon factory indicated a damage level of 35.6 %.

Leptoglossus sp breeds in alternative host plants like maize (and possibly in cashew) and moves into the cashew plantation to feed when the crop appears on the tree. The adult insect causes damage when it pushes it's proboscis through the shell of the developing nut to feed. The point of impact on the kernel then develops a necrosis and a rotting effect in the nut. This damage usually only becomes evident during the processing of the nut.

Selenothrips rubrocinctus causes damage to the tree when the large numbers of insects feeding on the underside of the leaves can cause a dehydration effect on the trees. Young tree growth would be stunted, and crop reduced.

The report by the consultant in August 1997 Report on Major Insect Pest Problem gave the available information on *Leptoglossus sp* and cashew. The consultant also recommended that research work be commenced at the University of El Salvador to look into the bio-ecology and bio-control of *Leptoglossus sp.* This recommendation was carried further by CRECER who gave support to a new research program.

F2. Report on Progress of Work by University

A report of the progress made by the University of El Salvador is as follows. The research program is in three parts, each part is being supported for one year:

1. Diversity and Abundance of *Leptoglossus zonatus* and other species in cashew at CORALAMA.

2. Evaluation of organic products to control *Leptoglossus sp.*

3. Evaluation of organic products to control Thrips.

F2a. Diversity and Abundance of *Leptoglossus zonatus* and other Species in Cashew at CORALAMA

This program commenced in June 1998 and the work is being done by student Hector Martinez supervised by Dr.. Serrano and others. The starting point for this program was the consultant's report of August 1997 Report on Major Insect Pest Problem at CORALAMA. Mr Martinez then carried the work further and his conclusions so far as follows:

Leptoglossus sp are a part of a more complex insect environment at CORALAMA and perhaps it may be getting the blame when sometimes other similar insects are also causing damage. *Leptoglossus sp* breeds in maize and *cucurbits* and moves to cashew to feed when the crop is at the right stage.

Martinez also found some Leptoglossus eggs on a cashew tree trunk, some 50 cm above the ground. In addition Leptoglossus nymphs (without wings) were found in cashew flowers. In this event it would appear that *Leptoglossus sp* has the potential to breed in cashew, although the main method of entry would appear to be from maize or *cucurbits*. *Leptoglossus sp* were found feeding on the weed Amatillo but they apparently do not breed there no eggs were found.

Martinez believes that there may be a number of species of *Leptoglossus* (probably four) at CORALAMA including the main culprit *Leptoglossus zonatus.* He has also found three other insects which may be important as follows:

-Euchistis sp(Pentatomidae Hemiptera)
-Largus sp (Largidae Hemiptera)
-Hyalimenus tarscatus (Alydidae Hemiptera)

There is as yet no evidence that these insects are causing damage in the plantation, however *Hyalimenus tarscatus* is recorded as a pest of cashew in Costa Rica.

Other discoveries include a potential predator and parasite. The eggs of a *ectoparasite* sp *Phoridea diptera largidae* was found in the body of an adult *Leptoglossus.* In addition a predaceous bug *Debilia sp, Reduvidae Hemiptera* is believed to be a potential predator of adult *Leptoglossus.*

The project is now undertaking a taxonomy of the insect collection - they have about 250 specimens involving about 25 different species. The University believes it must positively identify a few of the key species in this collection and it does not have the expertise to undertake this task. They have requested outside help.

The consultant is making the following recommendations to CRECER:

1. Assistance be given to the university to use entomological taxonomist Dr. Malipatil to undertake the necessary identification work to complete the work of this project.

2. The support for Mr. Martinez is due to finish in June 1999. The consultant recommends that his work as far as it relates to the discovery of the predator and parasite species be continued. This project should be pursued until we have more definitive information as to whether these species have potential to be developed into a control scheme. A 12 month extension of this project to concentrate on these issues would be a sensible investment.

F2b. Evaluation of Organic Products to Control *Leptoglossus*

This 12 month project by Pedro Onana and Francisco Dias commenced in February 1999. Onana and Dias collected information on various local plants an organic materials that apparently have insecticidal properties, some of these plants are native to El Salvador.

A total of 25 materials were tested for efficacy against Leptoglossus. The testing involved putting 10 adults and 10 nymphs in a cage, and each cage was put in an environment to simulate being in the plantation. Each of the 25 materials was made into a spray for application to the insects.

Of the 25 materials used only one - neem, was successful. Others tried included onion, garlic, tobacco, *Annona muricata, Malia azadirachtin, Cecropia paltata, Rutachalapansis etc.*

The neem used was purchased from Dominican Republic and Nicaragua, there was no technical information available on the neem. The recommended application rate for the neem for control of caterpillars (what neem is normally used for) is 1 part neem/200 parts water. This trial found a rate of 1 part neem/10 parts water gave a kill rate of 90 % to 95 % of adults in 3 days and similar kill of nymphs in about 30 minutes. Future trials will use neem at the following rates, 1 to 25, 1 to 50, 1 to 75, 1 to 125.

In addition some new organic materials will be tested and these are:

- *Eucalptys sp*
- *Enterolobium cylocarpium*
-*Ambrosia aumanansis*
- *Gliricidla supium*

The consultant comments as follows:

1. Previous work has determined that neem is not effective at normal rates against *Leptogloggus.* This is because neem acts as a slow acting stomach poison and the feeding habit of *Leptoglossus* negates the impact of neem. The results show so far that under laboratory conditions a good kill rate (90 %) can be achieved using 20 times the recommended dose.

2. Using at 20 times the recommended dose rate is hardly going to be economic on a commercial scale so the important information will be what is the minimum dose rate possible to still achieve satisfactory (say 60 % +) kill rate.

2. A practical control method for commercial use requires application of the spray by aircraft and sometimes by hand held sprayer. There are many more complications in the commercial use which tend to negate the effectiveness of insecticide application, such as thick tree canopy to penetrate with limited quantities of material.

4. The consultant will be sending some pyrethrum to the University for trial against *Leptoglossus.* Apparently pyrethrum cannot be obtained in El Salvador.

F2c. Evaluation of Organic Products Against Thrips

This project commenced in April 1999 is being conducted by Santo Diaz, Waldin Pereira and Jorquin Morales. As this project has just begun there is not much to report.

The stages of this project will be as follows:

1. Literature search on *Selenothrips rubrocinctus.*(the consultant will assist with this).

2. The list of materials to be tried will include madracacao, cow urine, neem, paraiso, soaps, chile and soap, aceituno, garlic, chichi caste and vinegar. the consultant will also be sending pyrethrum for trial.

F2d. Recommendations in Response to New Situation

1. CRECER to assist the university project Diversity and Abundance of Insect Pests at CORALAMA by supporting additional work by consultant and Dr. Malipatil to identify some insects found at CORALAMA. The consultant will carry the samples to Australia where the work to be completed.

2. CRECER to support the university project Evaluation of Organic Materials to Control Thrips by requesting the consultant and Dr. Malipatil to undertake a literature search of information on *Selenothrips rubrocinctus.* This work to be undertaken in Australia.

3. CRECER to purchase a copy of proceedings of International Cashew and Coconut Conference, Tanzania, February 1997. The consultant to assist this purchase.

4. CRECER to support a limited continuation of the university project Diversity and Abundance of Insect Pests of Cashew at CORALAMA. This extension could be 12 months to concentrate on further study of the two insects discovered to determine their predator or parasitic potential. These insects are (1) *Phoridea diptera largidae*, a possible parasitic species and (2) *Debilia sp*, a possible predator species.

5. A new project regarding the import of the green ant *Oecophylla smaradgina* for trial as a biological control agent in cashew at CORALAMA. The details about this project are described in the section G.

G. New Initiatives in Entomology

G1. Background to Green Ant

Insect pests are a major source of crop loss in virtually all cashew growing countries. These pests include sap-sucking bugs, leaf chewing caterpillars and beetles as well as thrips, aphids, scales, and stem borers. The importance of individual pests do vary from region, in general *helopeltis Helopeltis sp* is the most important cashew insect pest on a global basis but some of the others can achieve most important status in some places. In particular in El Salvador *Leptoglossus sp* is the most important insect pest.

In some cashew countries insect control is usually achieved by simple programs of spraying chemical insecticides, in other places no control measures are taken. There has been no previous significant work on biological control of insect pests in cashew prior to Dr. Peng's research.

Dr. Peng came to Australia in 1993 to study biological control in cashew. using his previous experiences he commenced work on a weaver ant that is indigenous in Australia. The weaver ant, *Oecophylla sp* is a tree ant and has two important species that are relevant to cashew. *Oecophylla smaradgina* (green ant) is indigenous in Australia, Asia and some pacific islands, while *Oecophylla longiloda* (red ant) is indigenous in Africa. This ants are not indigenous in South or North America.

The green ant was traditionally used to control insect pests in citrus in southern China for many years and it had previously been investigated for their potential in coconuts. However this work only had limited success because in establishing bio-control systems as the users were unable to manage the populations of the ant colonies. In particular there was the habit of fierce warfare breaking out between two ant colonies over perceived boundaries between colonies.

Peng has developed methods to prevent normal attrition between colonies and manage populations of colonies at a high level over a sustained period of time. This technology allows the establishment and maintenance of worrable bio-logical control system in cashew.

G2. Impact of Green Ant in Cashew

Peng's work since 1993 has shown that *Oecophylla smaradgina* is a highly efficient predator of the major insect pests of cashew found in Northern Australia. The pests that are effectively controlled are *Helopeltis pernicilis (Hemiptera, Miridea),* fruit spotting bug, *Amblypelta lutescens (Hemiptera Coriedae)* and green bug *Nerara vividula (Hemiptera Pentatomidea),* mango tip borer, *Penicillaria jocosatrix* (Lepidoptera Nochuidea), Leaf roller, *Anigraea ochrobasis* (Lepidoptera *Noctuidea),* and several other species of caterpillars and leaf beetles.

In addition experience in Australia has shown that these ants can also limit the spread of red banded thrips *Selenothrips rubrocinctus* in cashew and also reduce damage by *Leptoglossus* Nymphaea in acacia plantations.

Green ants have a close association with honey-dew producing insects such as scales, mealybugs

and aphids, but the ants have no significant impact on the main natural enemies of these pests. When green ants are present, predators and *parasitoids* of honey-dew producing pests are also present, and a balance exists resulting in very little damage to the cashew crop.

Research in Australia has found that where cashew trees are fully occupied by green ants very little damage is caused by insect pests. Tests have shown the following benefits:

1. Trees protected by geen ants give higher yields than trees protected by pesticides. Plots of trees protected by green ants gave yields 1.4 to 1.8 times higher than trees protected by chemicals This is because chemical control cannot stop all insect pest damage and it also kills other beneficial insects. The Tres protected by green ants gave yields up to 6 times more than trees with no pest control.

2. Green ants are a biological control system that are cheaper and easier to use than chemicals.

G3. Biology of Green Ant

The green ant exhibits strong social behavior (territorial and aggressive) and they live in trees using leaves to make nests. The details on the formation, establishment and development of green ant colonies is not well known in the technical literature, much of our improved understanding of the green ant has come from Peng's work.

These ants live in colonies which are controlled by queens. well established *coloniesmay* comprise from a say 50 to over 200 nests and may spread over up to 30 trees. In the dry season (non reproductive period) the colony consists of queens, big workers (8m to 11mm long) small workers (4mm to 6mm long) pupae, larvae and eggs.

The reproductive time for the ants in Australia is the wet season when mature colonies produce various sexual forms, winged males and females. Winged females are fertilized before they disperse to new territory, often to within 50 meters. In the new territory the winged females lay eggs and after the larvae appear the dealate queens make new communial nests. When worker ants emerge they make new nests and forage for food to assist establishment of the colony.

G4. Proposal for Trial of Green Ant in El Salvador

The best time for the trial would be at the end of the dry season as it is not the reproductive time for the ants and the movements and behavior of the ants can be easily controlled. This suggests a start time of November/December.

The whole trial would require about 4 to 5 months and so should be completed about April the following year. The trial requires the use of 10 to 15 cashew trees where the ant colonies can be isolated and protected. Adequate isolation would involve being a minimum of 10 meters away from other vegetation with a protective ditch around the plot of cashew trees. This ditch should be 30 cm deep and 40 cm wide and filled with water, this will ensure no possible escape of geen ants from the trial plot.

The trial procedure would involve Dr. Peng personally bringing up to three colonies of ants by air from Darwin, Australia in sealed containers and positioning these ants nests in the trees at the trial site. Peng

should be on site for about three weeks to set up the trial and instruct university staff on the required data to be collected. Peng would return to El Salvador towards the end of the trial to evaluate the results.

H. New Initiative - Anthracosis Control

H1. Background to Problem

Anthracosis is a fungal disease that is caused by the causal agent *Colletotrichum gloeosporioides.* This fungus particularly attacks new growth flushes and can thrive in certain environmental conditions (humid conditions where temperature are below 30 degrees Cover period of time and where tree canopies are inter-grown) It can attack a range of crops including mango, paw and cashew.

The normal treatments used for control of anthracosis in cashew are (1) preventing the inter-growth of tree canopies and (2) spraying with copper solutions where necessary. The use of copper sprays at CORALAMA obviously involve a cost of employing aircraft and purchasing materials and there is always a question of the efficiency of aerial spraying in situations of mature trees with large canopies.

The losses from anthracosis in El Salvador will vary from year to year but on average it is significant. This year may be worse than normal because of the impact of hurricane Mitch in October 1998.

Quite clearly anthracosis will continue to cause problems and we are not in a position to formulate better control strategies because we lack information, most importantly about the re-infection cycle in cashew. There are theories that the spores are coming from other crops nearby (which ones), and also that the source may be the leaf litter on the plantation floor.

H2. Recommendations

The consultant believes it is important to investigate the infection cycle of anthracosis in cashew in the El Salvador context. This work (6 to 12 months) could be carried out by the Crop Protection Department, University of El Salvador, (Ing. Wilberto Lara Rodriguez). This program cold be arranged on the same lines as currently operating with the entomology program at the university under Dr. Serrano.

I. Processing

II. CORALAMA Factory

The CORALAMA factory was closed for the 1998 season so no crop was processed. The whole 1998 crop was sold as raw nuts to India. The factory was still closed when the consultant visited CORALAMA in April 1999 and he was unable to gain access and make an inspection.

The consultant had previously made recommendation about the operations of the factory but this time he is unable to make any further comment. the consultant was advised that CORALAMA did intend to open the factory to process some of the 1999 crop, however apparently this depends on the resolution of a dispute between CORALAMA and the society representing the other plantations.

The consultant was able to visit the processing factory at San Ramon that was constructed with support from the Canadian government.

This processing system is described as follows:

1. Stogarage----------------------2.Grading---------------------3. Steam-------------------4.Shelling
|
|
8. Packing------------------------7. Grading---------------------6. Peeling-----------------5. Drying

The important details of the various stages are as follows:

IIa. Grading

Is done into three sizes and each grade is processed independently to make more efficient processing.

IIb. Steam

Autoclave system similar to CORALAMA but with much smaller capacity. Autoclave capacity is 3.5 quintals (300 lbs) of raw nuts which are steamed for up to 1.5 hours. Autoclave can run three shifts per day.

IIc. Shelling

Operating 9 shelling machine s made by Pearce Equipment of Brazil. These are similar to existing machines at CORALAMA but probably less well designed. Shelling capacity per machine is dependent on labour efficiency but could assume similar to CORALAMA .

IId. Drying

Batch drying oven with capacity of 27 lbs of kernel per shift. Procedure is to dry batch at 80 degrees for 3.5 hour to reach the required 4.5 % moisture level.

IIe. Peeling

Hand labour employed. Pearce peeling machine has been tried and it has been found to break too many whole kernel. It is now used solely to peel broken grades.

IIf. Grading

Grades are produced, white wholes, scorched wholes, white splits, scorched splits, white pieces and scorched pieces.

According to factory management the following labour requirement is necessary to operate when working at the full capacity of 6 quintals (272 kgs) of raw nuts per day.

Manager - 1
Steam - 1
Shelling - 18
Drier - 1
Peeling - 12 to 14
Grading - 6 + supervisor

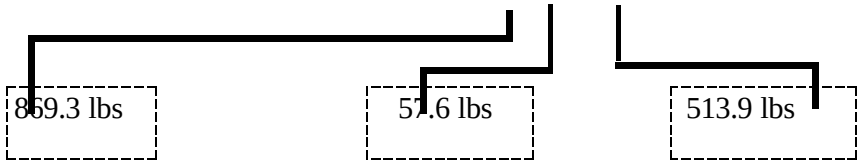
The grading includes the recovery process to rehabilitate damaged kernel.

The consultant examined the records of the factory to establish the efficiency of the process and the condition of the crop being processed.

The following details of crop processed between 22 March and 4 April 1999 are relevant:

Volume Raw Nuts - 4,648.7 lbs

Volume Kernel After Shelling - 1,440.8 lbs



Final Product | Kernel skin | Kernel wasted (insect/disease damage)

The above results show that 35.6 % of the final crop was wasted because of damage mainly caused

by insect pests. In this the results are similar to that of CORALAMA over the past three years.

As one measure of the factory efficiency the following data was available:

Grade of final product	- white wholes	28.4 %
	- scorched wholes	13.8 %
	- white splits	20.5 %
	- scorched splits	3.6 %
	- white pieces	25.2 %
	- scorched pieces	8.5 %

A summary of the key criteria in processing shows the following:

% whole grades	- 42.2 %
% scorched grades	- 25.9 %

42.2 % whole grades is low by international standards, but is about the same that was achieved by CORALAMA and 25.9 % scorched is high by best practise standards. While no doubt improvements can no doubt be made in processing efficiency it is the damage caused to the crop mainly by insect pests that contributes to the poor processing results.

J. Marketing of Cashew

UCRAPROBEX are the marketing agents for CORALAMA and it is understood that they reveived a 5 % selling commission. The information available to the consultant regarding the disposition of the crop in the past three years was as follows:

	MT processed	Sold to India	
		Volume (MT)	Price/MT (fob)
1996	100	423	US$ 680
1997	136	476	US$ 475
1998	nil	460	US$ 675
1999	135 *		

* note consultant advised that CORALAMA will process 145 MT in 1999 if they can open their factory.

J1. Kernel Sales

The consultant has no information on prices received for sales of kernels. Previous sales of kernel were made to Ports West of Canada, however this contact has soured as apparently Ports West have failed to pay amounts due.

On previous occasions the consultant introduced two potential buyers of organic kernel in Australia.

However UCRAPROBEX have not yet followed up these leads. During the current assignment the consultant met with UCRAPROBEX and again submitted the details of these potential buyers as follows:

1. Jorgenson Waring Foods Pty Ltd
   Sydney, Australia
   Phone 61 - 2- 9391 1966
   Fax 61 - 2- 9391 1949
   Attention Chris Joyce

2. Michael Waring Trading
   Sydney, Australia.
   Phone 61 - 2- 9687 9233
   Fax 61 - 2- 9687 9363

The consultant makes comment that if CORALAMA wish to establish an export market as a supplier of organic kernel then they must be able to give regular supply. While price issues are important, above all buyers respect the reliability of suppliers if a long term relationship is to be built. This means CORALAMA being able to process crop every year.

J2. Raw Nuts Sales

The sales in the past few years have been to the same buyer Vijalaxmi, a major Indian processing company. The prices received in the past few years are among the lowest in the international trade. The reasons for the low prices are probably as follows:

1. Poor quality crop, 35 % crop damage due to insect damage.

2. Crop volumes on offer are small by standards of international trade and El Salvador is isolated from main producing countries.This leads to low bargaining position for CORALAMA.

The consultant makes comment that processing the crop and selling organic kernel is much more profitable for CORALAMA than selling raw nuts to India.

The following simple calculations demonstrate this point. The unit of comparison is the disposal of 1,000 kg of raw nuts.

J3. Kernel Sales

Assume 1,000 kg raw nuts processed to 200 kg kernel.

200 kg kernel	- 45 % wholes - 90 kg @ US$ 7.0/kg	- US$ 630
	- 55 % broken - 110 kg @ US$ 5.0/kg	- US$ 550
		1,180
	Less processing operating costs	180
	Margins after processing	1,000

This is compared to the US$ 675/MT received for raw nut sale